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REPORT MDC-A0514- REV-A
30 JUNE 1970
REVISION A
30 SEPTEMBER 1976
COPY NO. 72

Percussion Primers, Design Requirements,

Revision A,

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ABSTRACT

Percussion primers are the key to many critical functions in aerospace ordnance hardware. This report is to be used as a specification for the use of percussion primers. It also provides the historical background of priming compositions through to the most recent high temperature resistant mixes. Input energy to fire a primer with adequate safety margin is discussed, together with primer output. The influence of primer reconsolidation, flash hole size and baffling to reduce primer violence are included. Design data sheets for those primers most frequently used in MCAIR pyrotechnic components are included.

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1.0 INTRODUCTION

The purpose of this report is to acquaint, refresh and guide the aerospace ordnance designer with the fine points of selection and use of center fire percussion primers for aerospace application.

Percussion primers, which appear to have been independently invented about 1815, by an American, Joshua Shaw of Philadelphia and an Englishman, Joseph Egg (References 1 and 2), form part of a general family of pyrotechnic components classified as initiators. Included in this grouping but of 20th century vintage are stab primers, stab detonators and electric initiators. While the electric initiator requires the application of an electric current to heat up a resistive bridgewire to provide the igniting stimulus, both the percussion and stab primers as well as stab detonators function by the application of mechanical energy in the form of a rapidly impacting firing pin.

The percussion primer is probably the smallest component the pyrotechnic designer is likely to encounter. As such it is likewise the most frequently overlooked and misunderstood component. Its function may be likened to an energy transducer, wherein it converts mechanical energy from a suitable energy source into chemical energy in the form of a deflagrating (to near detonating) pyrotechnic reaction. Since the primer functions as the link between the energy source and the ordnance device end operation, it becomes the key to many critical functions. Contrary to popular belief, percussion primers do sometimes fail to function despite the application of adequate input energy. Failure analysis in nearly every case reveals that the malfunction is due to either incorrect primer inspection or installation. The purpose of this report is to provide the pyrotechnic engineer with design parameters, as well as new information on the usage of percussion primers. This report covers the following design points:

- Selection of the proper primer to fit the specific ignition requirements.
- Selection of the optimum priming mix for the temperature environment anticipated.
- X-ray inspection and dimensional selection of the primers prior to installation.
- Primer pocket sizing and reconsolidation recommendations.
- Firing pin design and firing energy requirements.
- Primer output energy.

2.0 PRIMER CHARACTERISTICS

2.1 GENERAL

Typical construction of a center fire percussion primer is shown in Figure 1, which also depicts both the two and three legged blunt anvil variations common to different primer manufacturers. The pointed anvil design shown in Figure 2 is used exclusively for shotgun shell primers (sometimes referred to as battery cup primers). Primer assembly consists of loading an impact sensitive mix into the primer cup, covering it with a paper disc and then pressing the anvil into place. Impact by a suitably constructed hemispherical end firing pin on the metal primer cup produces an indentation in the latter. This locally compresses the impact sensitive mix between the indentation and the anvil causing it to deflagrate. Since the primer cup is not perforated, the percussion primer unlike the stab primer, is capable of maintaining a relatively high pressure gas seal. The primer cups are generally constructed from a ductile metal such as cartridge brass, to permit the required deformation by the firing pin while still maintaining integrity of the primer cup.

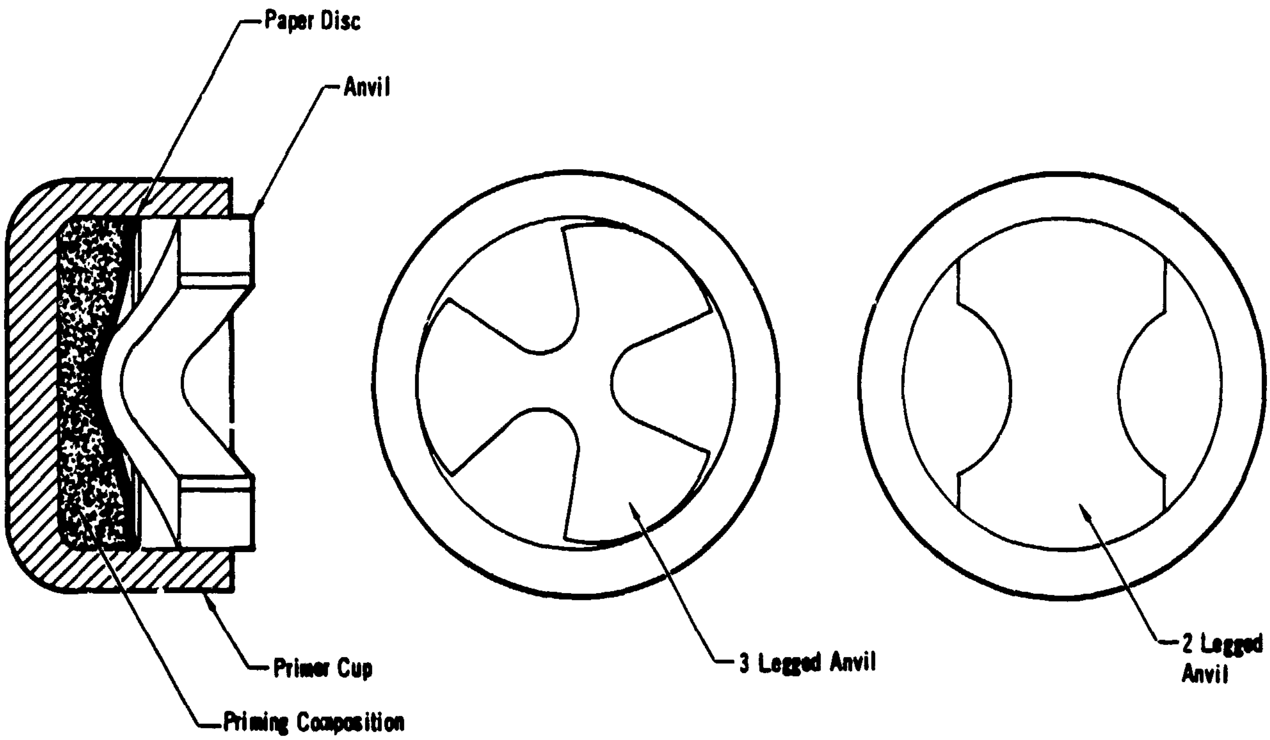

Figure 1 Commercial or Military Center Fire Primer

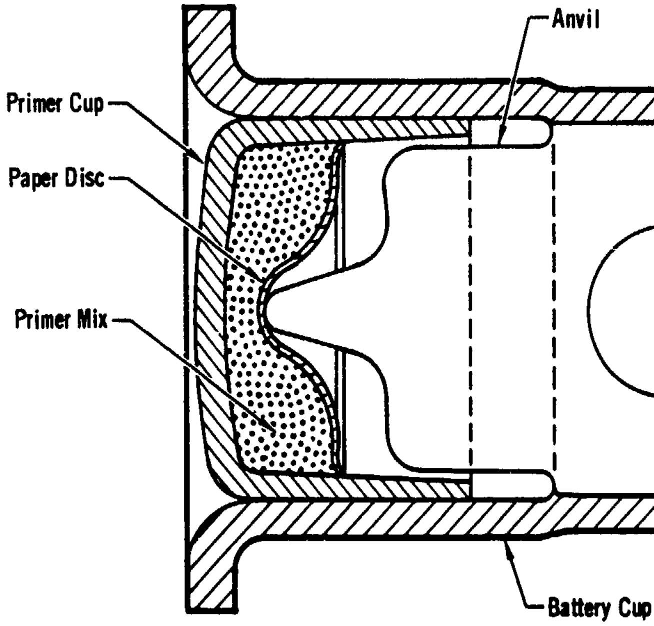

Figure 2 Shotshell or Battery Cup Primer

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The impact sensitive mixes, which are more frequently referred to as priming mixes or compositions, consist generally of a primary explosive, an oxidizer, a fuel and occasionally an abrasive material to increase sensitivity to initiation. Primary explosives are incorporated because of their ability to explode when exposed to either shock, friction (and heat) or any combination of these stimuli. The earliest known primary explosives, namely platinum, gold and silver fulminates (from the Latin, fulmenare, meaning strike with lightning) were described as early as 1602. Some fifty years later mercury fulminate was discovered and by 1800 its preparation and properties had been well established. In the late 1930's mercury fulminate formulations were gradually replaced by the much more stable lead styphnate which had first been reported in 1914. Despite this trend mercury fulminate did not completely disappear from general use until after World War II.

The presence of an oxidizer, such as a chlorate or nitrate, in priming compositions is necessary due to the poor oxygen balance of the primary explosive present. Probably the most frequently used fuel for priming compositions is antimony trisulfide, since it also doubles as an abrasive.

2.2 SELECTION

As previously stated, the designer of an explosive train has two forms of initiating stimuli available, namely electrical and mechanical energy. In selecting the latter mode, which frequently involves less constraints than imposed by the use of electric initiators, the designer also has the option of choosing either stab or percussion initiated components. The former is of value when the available mechanical initiating energy is low but it suffers from the possible disadvantage of back venting through the perforated cup. While the percussion primer provides a gas seal, it does necessitate the availability of approximately twice the energy required for initiating the stab devices. As a general rule it is best for the designer to select the least sensitive initiator available that is compatible with all of his requirements.

Once the designer has decided upon the use of a percussion primer he must further select one compatible with the train to be initiated. For example, a pyrotechnic delay generally requires the least brisant primer available in order to provide surface ignition and to prevent column breakup from the shock. Initiation of an explosive train, on the other hand, is aided by the use of the most brisant primer in order to build up the detonation rates as rapidly as possible.

2.3 PRIMING COMPOSITIONS

2.3.1 Commercial Formulations - Commercial priming compositions today can best be divided into the non-corrosive and the corrosive type formulations. Because of the maintenance impact on the small arms users (Reference 3), primers containing the non-corrosive compositions are by far the most commonly used, and are generally referred to as the styphnate type. Exact formulations for these commercial lead styphnate compositions are considered, by the individual primer manufacturers to be proprietary and are therefore not available for publication.

The second class of commercial priming compositions, namely the corrosive type, contain no primary explosive materials. The earliest formulation of this class was developed in about 1922 by the Winchester Arms Company specifically as a replacement for the mercury fulminate priming composition which had been found to deteriorate rapidly under tropical conditions. These compositions were based upon the reaction between lead thiocyanate and potassium chlorate, wherein the former acts primarily as a fuel, but also exhibits a marked sensitizing effect upon the latter. Winchester's first formulation was subsequently sold (for one dollar) to the government after which the Army assigned it the now well known FA-70 designation (Reference 4). Three typical lead thiocyanate/potassium chlorate priming mix formulations are shown in Table I for informational purposes. The corrosive effects of this type composition result from the formation of soluble chloride combustion by-products produced by the chlorate oxidizer. The vendor advertised elevated storage specification for both corrosive and non-corrosive priming compositions are a minimum of one year at 160°F dry storage, however, Table II data on the M42 primer indicates a limited higher temperature capability. NOTE: Any utilization of primers above the specified temperature limits must be with the written approval of MCAIR.

2.3.2 Military Formulations - Because of proprietary problems associated with the commercial priming compositions, the U.S. Army through their Picatinny Arsenal facilities developed a number of formulations based on lead styphnate. The formula for the most frequently used military equivalent, designated PA 101 is shown in Table III. Although this was historically developed as a substitute for the commercial thiocyanate/chlorate priming compositions, primarily for the ignition of pyrotechnic time delays (Reference 9), it is considerably more brisant.

Table I Typical Thiocyanate/Chlorate Priming Compositions

	Commercial (Approximate) Percent by Weight	Military (6) (FA-70) Percent by Weight	Military (7) Percent by Weight
Lead Thiocyanate	25	25	17
Potassium Chlorate	33	53	35
Antimony Trisulfide	25	17	30
TNT	3	5	3
Calcium Silicide	14	-	15
	100	100	100

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Table II Storage Data for M42 Primers Loaded with Commercial Lead Thiocyanate/ Potassium Chlorate Priming Mix and Assembled into M71 Cartridges (8)

Storage Temperature (°F)	Safe Exposure Limits		Unsafe Exposure Limits	
	Duration	Firing Data	Duration	Firing Data
140	39 Months	100% Fired	42 Months	100% Misfired
160	121 Weeks	100% Fired	146 Weeks	100% Misfired
180	41 Weeks	100% Fired	42 Weeks	40% Misfired
200	16 Weeks	100% Fired	17 Weeks	80% Misfired

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Table III PA 101 Military Lead Styphnate Priming Composition (6 & 9)

	Percent by Weight
Lead Styphnate (Basic)	53
Barium Nitrate	22
Antimony Trisulfide	10
Aluminum (Powdered)	10
Tetracene	5
	100

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2.3.3 High Temperature Formulations - As a result of examining initiators recovered from a B52 crash in April 1957, Frankford Arsenal found that they showed degradative effects, particularly in the primers, from exposure to temperatures in excess of the normally accepted high of 165°F. Historically it was determined that these same initiators had previously been installed on a B47 that had been based in the desert. It should be noted that it was customary practice at that time to "inspect and repair as necessary" cartridge actuated devices removed from aircraft prior to their return to stock. Naturally visual examination would not reveal the degraded condition of the primers and hence their reuse. It was subsequently confirmed through a test program performed at Yuma, Arizona, that solar radiation of a B47 cockpit could produce internal temperatures as high as 180° to 200°F. In 1959 Frankford Arsenal therefore undertook the development of a high temperature resistant priming composition. Since it was felt that higher performance aircraft would also require improved temperature resistant primers, a goal of successful functioning after 2000 hours exposure at 400°F was established. Remington Arms Company subsequently developed a number of promising high temperature priming compositions, identified by the prefix 'G' (Reference 10). Of the twenty three reported mixes, both G-11 and G-16 (Table IV) showed the best long term high temperature capability with the latter exhibiting some limited capability for operation above 400°F (Reference 11). The #49 primers loaded with G-11 priming mix have exceeded the original design goal by 1000 hours, wherein successful firing was achieved after 3000 hours storage at 400°F. It should be noted that significant desensitization will occur if primers loaded with G-11 or G-16 priming composition are allowed to be exposed to high humidity following any high temperature exposure. The basic sensitivity of the G-11 and G-16 mixes are considerably less than that of the styphnate compositions and therefore require considerably increased firing energy for initiation. The brisance levels of the G-11 and G-16 formulations, under conditions of maximum confinement, are of the same order of magnitude as the lead styphnate type compositions.

Table IV High Temperature Resistant Priming Compositions

	G-11 Percent by Weight	G-16 Percent by Weight
Potassium Chlorate	53	53
Antimony Trisulfide	25	30
Calcium Silicide	12	17
TACOT*	10	
	100	100

*TACOT is the trade name for a DuPont high temperature resistant secondary explosive.

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2.4 INPUT CHARACTERISTICS

2.4.1 Firing Pin Design - Although percussion firing pin design criteria have not been refined to the same extent as that required for the initiation of stab devices, it has been determined that a firing pin with a hemispherical tip gives improved sensitivity over that of a truncated cone. The radius of the tip, however, appears to have little effect on sensitivity (Reference 6). Nevertheless, manufacturers recommendations for tip radius, which range from .020 to .050 inches, should be followed for each individual application. For example, the hand grenade type of firing mechanism (with rotational travel) has in the past used a firing pin tip with an .020 inch radius of curvature, while the tips of small arms firing pins (with linear travel) are generally about .045 inches. (Reference 12). Ⓐ

2.4.2 Firing Pin Energy - Primer manufacturers in their data sheets customarily provide the 100% "all-fire" level of their products. This is essentially the same as the mean firing height plus five standard deviations or $(\bar{H} + 5\sigma)$ x (drop weight), where $\bar{H}$ is the mean firing height, σ is the standard deviation and the drop weight is that specified in the primer manufacturer's specification. It should be noted that these data are based on reconsolidated primers, to be discussed later, fired at ambient temperature (72°F). Since these would be considered optimum conditions, it is highly desirable that an added margin of input energy be provided. McDonnell Aircraft Company requires that this be accomplished by using twice the specified mean firing height plus the five standard deviations $2\,(\bar{H} + 5\sigma)$.

2.4.3 Primer Cup Indentation - Any discussion of firing pin design is not complete without mentioning primer cup indentation. Uncontrolled indentation can lead to penetration of the primer cup, which results in some back-venting of the primer as it functions. On the other hand, too small an indentation may not adequately collapse the cup against the priming composition and the anvil, resulting in a no-fire. It has been found that a depth of .020 to .025 inches should be considered ideal for small diameter (pistol type) primers, while a figure of .025 to .030 inches should be used for large rifle type primers. Although lower indentations may be acceptable, a minimum indentation of .012 inches should be observed, since anything less than this is a "light blow" and may be the cause of a malfunction. Ⓐ

2.5 OUTPUT CHARACTERISTICS

The output characteristics of a percussion primer can best be described as a deflagration of low brisance with the accompanying emission of hot particles, flame and gases. In the past, various physical parameters of the primer's output have been measured in an effort to evaluate or compare same. Such measurements have included volume of gas produced, impulse imparted to a column of mercury by the pressure pulse, closed bomb data, light and temperature output. Even two standard military explosive tests, namely the sand crush and lead disc tests, have been employed with the most brisant primers, in an effort to gain more meaningful information. All the above tests, however, tend to be empirical and nonqualitative in nature and at best provide only limited primer to primer comparison. Quantitative measurements of total energy, however, can now be obtained for any detonating or pressure producing device by the McDonnell developed Initiator Output Test Fixture (Reference 13, sometimes known as the Energy Sensor). For primers, the specific value of such an instrument is its ability to integrate the pressure time output, thereby providing a quantitative measure of total energy. With such equipment, variations in primer output within lots, lot to lot and between different types of primers can now be determined. As an example, M42 primers containing commercial thiocyanate/chlorate priming composition have always been regarded as "softer" than M42 primers containing the PA 101 mix. Actual tests of these two types of M42 primers in the Initiator Output Test Fixture (Table V) not only showed the distinctly different energy levels, but also the output variations associated with the two types of priming composition. The difference in output energy levels between these two types of priming mix has also been confirmed as a result of qualitative measurements made using UV/IR techniques (Reference 14).

Table V Comparison of Energy Data for M42 Primers Loaded with Commercial Thiocyanate/Chlorate Mix and PA 101 Mix*

	Commercial Mix	PA-101 Mix
Low	25 in. lb.	74 in. lb.
High	105 in. lb.	123 in. lb.
Average	61 in. lb.	103 in. lb.

*Data based on tests of twelve primers of each type.

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For informational purposes, it should be noted that Remington Arms Company primers containing the lead styphnate based 5086 priming composition are also somewhat "softer" than primers containing the PA 101 composition. This probably results from the substantially lower styphnate content in the Remington mix (Reference 15). (A)

While in the past the aerospace ordnance designer has had the option of selecting primers for a specific job, for example, pyrotechnic pressed column delays are more easily developed using "softer" primers for initiation, the need to withstand longer periods of time at higher elevated temperatures is rapidly eliminating these options. Since this will probably mean greater use of the more energetic type priming compositions, quantitative measurement of primer output becomes even more significant for effective utilization. It is recognized that while the quantitative measurement of primer output, described above, does not provide the full story for the designer, the data generated when properly applied, can be used to produce an engineered application rather than one based on intuition, experience and luck. The Initiator Output Test Fixture will provide a valuable insight in the design and utilization of percussion primers, however, its use is not mandatory.

2.6 MISCELLANEOUS CHARACTERISTICS

2.6.1 Primer Reconsolidation - In order to fully use the primer manufacturers' firing sensitivity levels, it is necessary to follow their recommendations for primer reconsolidation. This simple operation, in which the primer anvil is reseated further into the primer cup, is usually accomplished concurrently with their installation. Failure to perform this operation will result in a primer sensitivity level different from that quoted by the primer manufacturer.

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2.6.2 Primer Flash Hole - The primer flash hole is located in the base of the primer pocket. It ports the primer deflagration products to the first fire or primary explosive increment of the powder trains to be initiated. Generally it is assumed that as the size of the flash hole is decreased, then the pressure of the deflagration products and the length of their "spit" would increase. Since ignition of pyrotechnic delay trains benefit by keeping pressure (and brisance) to a minimum, this dictates use of the largest flash hole practical. By the converse, initiation of explosive trains is aided by higher pressures and therefore a smaller diameter flash hole. Propellant ignition is less well defined, but would appear to fall somewhere between the two extremes discussed above. According to Reference 16 there seems to be some question as to the overall influence of variations in the diameter of the hole and its effect upon initiation of a firing train. Since quantitative design parameters have yet to be established it is recommended that information provided in the Appendix A data sheets be followed. This information is based on qualified components.

2.6.3 Primer Back-Up Disc - In aerospace type applications the use of a washer-type primer back-up disc is a necessity where gas sealing is required. Although the primary purpose of the back-up disc is to prevent blow-back of the primer body, their thickness can also be varied in order to control firing pin indentation. (A)

2.6.4 Baffling - Baffling is the well established technique for mechanically reducing primer brisance, primarily in pyrotechnic time delay applications (Reference 17). This technique is quite often overlooked or discarded because of the additional complexity involved. With the present availability of porous sintered metal in varying thicknesses, it is believed that baffling can now be achieved with greater simplicity and improved versatility. This is of considerable importance in view of the increased use of the more brisant and better temperature resistant priming compositions.

3.0 INSPECTION AND QUALITY CONTROL

There are three equally important inspection and quality control requirements that are mandatory when using percussion primers. They are as follows:

- Use of new primers
- Establishment of primer lot control
- X-raying of all primers

The use of new primers (not greater than one year old) permits the incorporation of a primer that does not have a prolonged and unknown storage history. With the trend towards a longer installed service life for pyrotechnic components specifically in aircraft, this facet becomes increasingly significant if the much discussed goal of ten years is to be achieved.

In procuring primers from the manufacturer, the primer users should establish his own lot control to provide traceability in the event any primer anomoly is discovered at a later date. In addition, record keeping and proper identification form a necessary extension of lot control.

The X-raying of primers prior to installation permits their screening to see that all parts are present and assembled correctly. Although this type of deficiency is extremely rare, the cost of X-raying the relatively small quantity of primers involved in aerospace pyrotechnic lots is minor. The fallout, of course, is the increased confidence of now knowingly installing only good primers.

Finally, it is mandatory that primer users obtain from the primer manufacturer, certification detailing firing energy data for the primers involved. Although it is not considered mandatory, primer users may want to verify this information by performing their own input energy measurements.

4.0 SPECIFIC PRIMER APPLICATION AND SELECTION

Selection of the optimum primer for a task must be based initially on the anticipated continuous upper temperature limit, since this has the greatest influence on which priming composition to use. The continuous maximum temperature is defined as that upper temperature the aerospace vehicle will experience accumulatively during normal operational life. The maximum life of priming compositions at continuous elevated temperature has been previously discussed. The continuous maximum temperature should therefore be used as the yardstick, although short duration excursions above this temperature can be tolerated by most priming compositions without degradation. The designer should therefore select the thiocyanate/chlorate type mix for use where the maximum continuous temperature does not exceed 160°F. For maximum continuous temperatures of 200°F, the styphnate/chlorate type priming compositions should be selected and the G-11 type mix for temperatures between 200°F and 400°F. In addition to temperature, consideration must also be given to the powder train increment to be ignited and to the energy available to fire the primer. With the former, the advantage of using a soft primer (as temperature will permit) must be weighed against selecting a more brisant primer and the possible need of having to incorporate a mechanical baffle if the latter primer is to be used for igniting a pyrotechnic delay. Finally, selection of the high temperature resistant priming compositions (G-11 etc.) require delivery of at least three times as much energy to fire the primer compared with primers containing either commerical or military styphnate/chlorate mixes.

The Percussion Primer Selection Logic Chart shown in Table VI is provided for a systematic selection of primers, based on maximum continuous temperature, relative primer violence, ignition characteristics and firing sensitivity.

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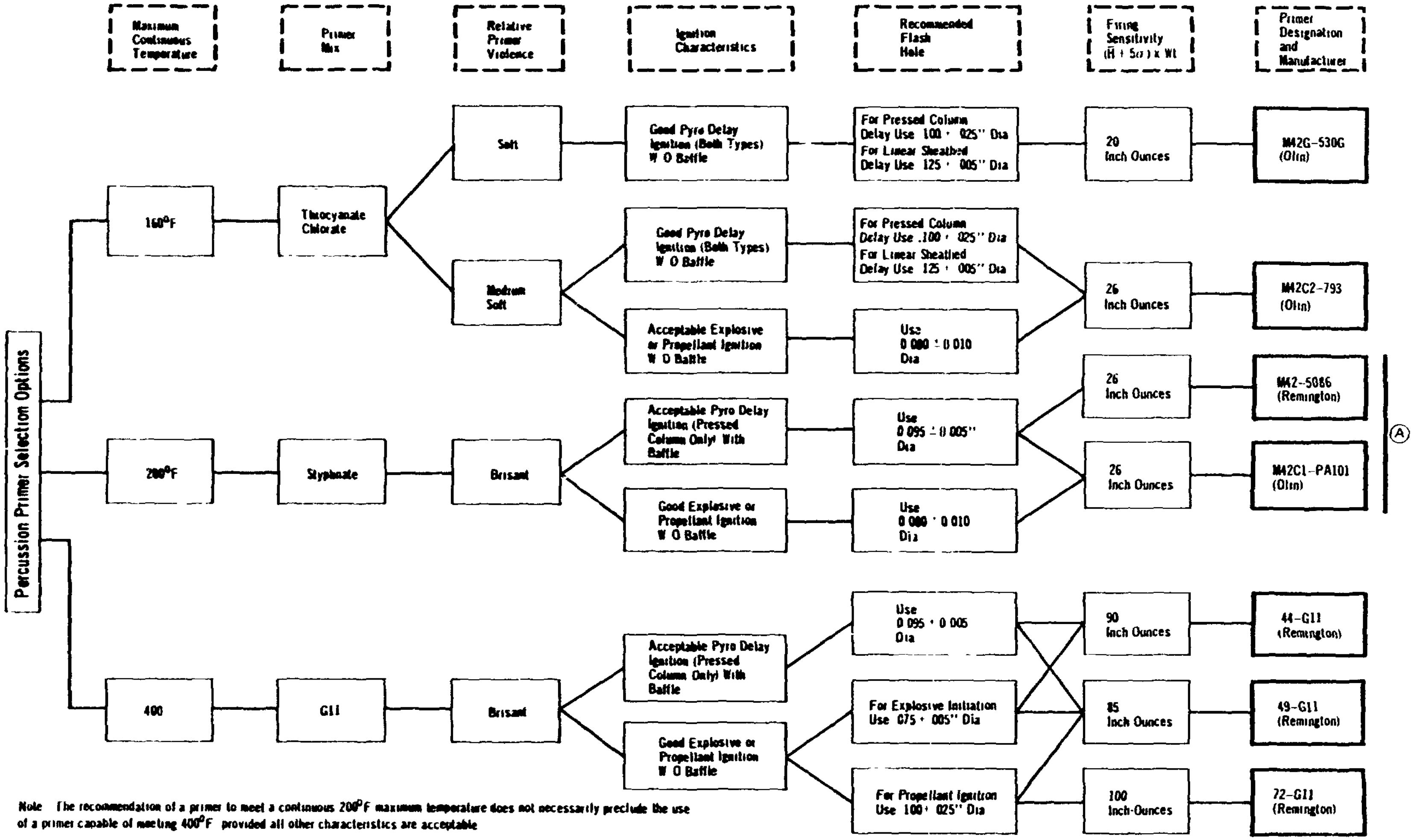
Table VI – Percussion Primer Selection Logic Chart



Note The recommendation of a primer to meet a continuous 200°F maximum temperature does not necessarily preclude the use of a primer capable of meeting 400°F provided all other characteristics are acceptable

5.0 REFERENCES

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(3) B. A. Rausch, "Evaluation of Several Styphnate-Type Primer Compositions, "Picatinny Arsenal Report PATR 2200, August 1955.

(4) A. S. Hill, Private Communication, April 1970.

(5) "Ordnance Explosive Train Designer's Handbook," Naval Ordnance Laboratory Report NOLR-1111, April 1952.

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(7) "Military Explosives," Department of the Army Technical Manual, TM9-1910, April 1955.

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(9) T. W. Stevens and K. G. Sheffield, "PA-101 Primer Mixture for Initiating Delay Compositions," Samuel Feltman Ammunition Laboratories, Picatinny Arsenal, Report No. 10, April 1957.

(10) A. Schlack and T. G. Ciccone, "High Temperature Percussion Primer," Propellant Actuated Devices Symposium, Frankford Arsenal, June 1961.

(11) T. B. Johnson and J. F. Kenney "Feasibility Study of Percussion Primers Between 400°F and 600°F," Frankford Arsenal Report M66-9-1, October 1965.

(12) A. S. Hill, Private Communication, August 1971. A

(13) M. L. Schimmel and V. W. Drexelius, "Measurement of Explosive Output," Proceedings of the Fifth Symposium on Electroexplosive Devices, Franklin Institute, June 1967.

(14) M. G. Kelley, "A Radiant Energy Technique to Measure Explosive Output," Proceedings of the Fifth Symposium on Electroexplosive Devices, Franklin Institute, June 1967.

(15) T. B. Johnson, Private Communication, November 1973. A

(16) R. L. Wagner and E. L. Miller, "Influence of Flash Hole Diameter on Percussion Primer Functioning Characteristics, "Feltman Research and Engineering Laboratories, Picatinny Arsenal, Report No. 52, February 1959.

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APPENDIX A

Table A–1 Design Data Sheet Summary

Data Sheet Number	Primer Designation	Type Priming Mix	Manufacturer
1	M42G–530G	Thiocyanate/Chlorate	Olin
2	M42C2–793	Thiocyanate/Chlorate	Olin
3	M42C1–PA101	Lead Styphnate	Olin
4	44–G11	G11	Remington
5	49–G11	G11	Remington
6	72–G11	G11	Remington
7	M42–5086	Lead Styphnate	Remington

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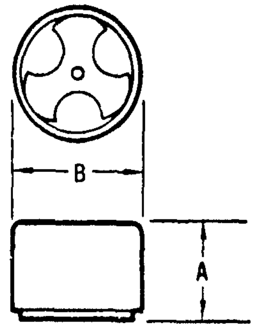
DATA SHEET NUMBER 1	PRIMER DESIGNATION: M42G–530G

Manufacturer's Dimensions

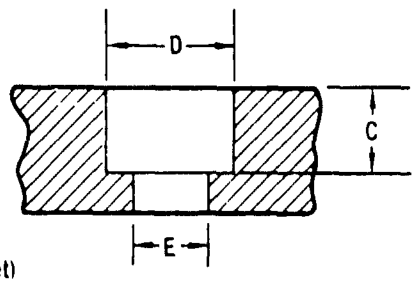


Dimension 'A' .111 to .119 inches.*

Dimension 'B' .1748 to .1756 inches.

*Note: For ease of assembly hand inspect and select only those primers that fall between .115 and .119 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole

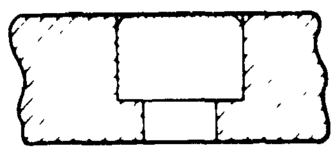


Dimension 'C' .113 ± .001 inches.

Dimension 'D' .1740 ± .0005 inches (use for brass primer pocket)

Dimension 'E' .125 ± .005 inches (use pyrotechnic time delay ignition).

Primer Reconsolidation



Olin recommends that primers can be reconsolidated (seating the anvil) from .002 to .006 inches during installation.

Firing Pin Recommendations

Hemispherical firing pin with 045 inch radius tip.

Primer Cup Indentation

Ideal 020 to 025 inches

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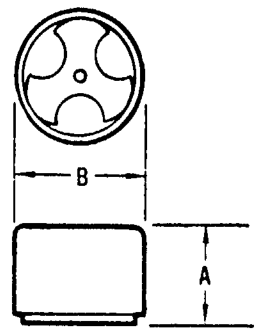
DATA SHEET NUMBER 2	PRIMER DESIGNATION: M42C2-793

Manufacturer's Dimensions

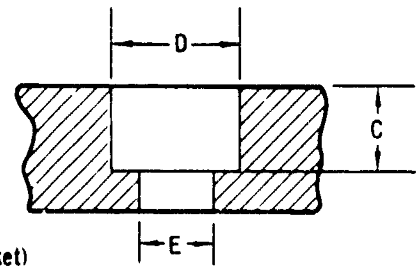
Dimension 'A' .111 to .119 inches*

Dimension 'B' .1748 to .1756 inches



*Note: For ease of assembly hand inspect and select only those primers that fall between .115 and .119 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole



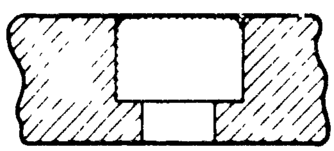
Dimension 'C' .113 ± .001 inches.

Dimension 'D' .1740 ± .0005 inches (use for brass primer pocket)

Dimension 'E' .125 ± .005 inches (use for pyrotechnic time delay ignition)

.080 ± .005 inches (use for explosive train or propellant powder ignition)

Primer Reconsolidation



Olin recommends that primers be reconsolidated (seating the anvil) from .002 to .006 inches during installation.

Firing Pin Recommendations

Hemispherical firing pin with 045 inch radius tip.

Primer Cup Indentation

(A)

Ideal 020 to 025 inches

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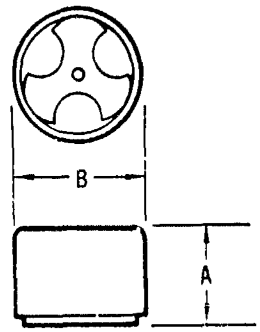
DATA SHEET NUMBER 3	PRIMER DESIGNATION: M42C1-PA101

Manufacturer's Dimensions

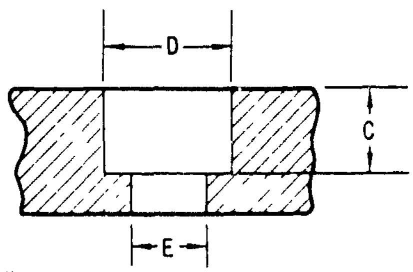


Dimension 'A' .111 to .119 inches*

Dimension 'B' .1748 to .1756 inches.

*Note: For ease of assembly hand inspect and select only those primers that fall between .115 and .119 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidatinn.

Primer Pocket and Flash Hole

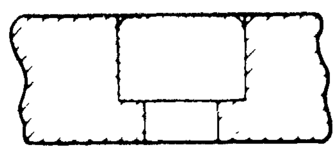


Dimension 'C' .113 ± .001 inches.

Dimension 'D' .1740 ± .0005 inches (use for brass primer pocket).

Dimension 'E' .095 ± .005 inches (use for pyrotechnic time delay ignition).
.080 ± .010 inches (use for explosive train or propellant powder ignition).

Primer Reconsolidation



Olin recommends that primers be reconsolidated (seating the anvil) from .002 to .006 inches during installation.

Firing Pin Recommendations

Hemispherical firing pin with 045 inch radius tip

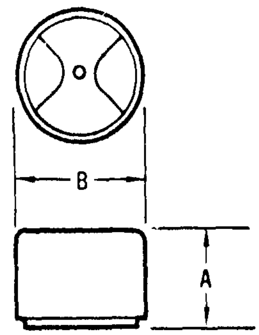
Primer Cup Indentation (A)

Ideal 020 to 025 inches

TP8834-15

DATA SHEET NUMBER 4	PRIMER DESIGNATION: 44–G11

Manufacturer's Dimensions

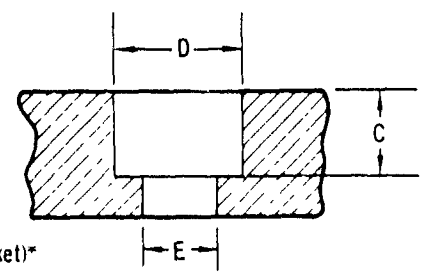


Dimension 'A' .115 to .122 inches*

Dimension 'B' .1746 to .1751 inches, however the two petal anvil gives an eccentricity of up to .1756 inches.

*Note: For ease of assembly hand inspect and select only those primers that fall between .118 and .122 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole



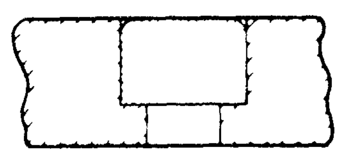
Dimension 'C' .116 ± .001 inches.

Dimension 'D' .1740 ± .0004 inches (use for brass primer pocket)*
.1742 ± .0004 inches (use for aluminum primer pocket)*

Dimension 'E' .075 ± .005 inches (use for explosive train initiation).
125 ± .005 inches (use for propellant powder ignition).

*Note: These dimensions require an 80 to 100 pound installation force for the primer within the primer pocket.

Primer Reconsolidation



Remington recommends that the primers be reconsolidated (seating the anvil) from 002 to 006 inches during installation.

Firing Pin Recommendations

Hemispherial firing pin with .037 to .050 inch radius tip.

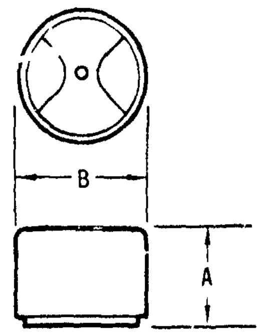
Primer Cup Indentation

Ideal 020 to 025 inches (A)

TP8834-16

DATA SHEET NUMBER 5	PRIMER DESIGNATION: 49–G11

Manufacturer's Dimensions

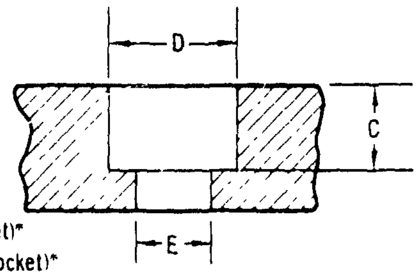


Dimension 'A' .115 to .122 inches*

Dimension 'B' .1746 to .1751 inches, however the two petal anvil gives an eccentricity of up to .1756 inches

*Note: For ease of assembly hand inspect and select only those primers that fall between .118 and .122 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole



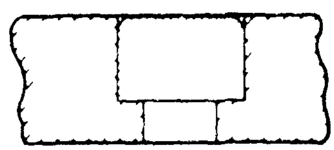
Dimension 'C' .116 ± .001 inches.

Dimension 'D' .1740 ± .0004 inches (use for brass primer pocket)*
.1742 ± .0004 inches (use for aluminum primer pocket)*

Dimension 'E' .075 ± .005 inches (use for explosive train initiation.)
.125 ± .005 inches (use for propellant powder ignition)

*Note: These dimensions require an 80 to 100 pound installation force for the primer within the primer pocket.

Primer Reconsolidation



Remington recommends that the primers be reconsolidated (seating the anvil) from .002 to .006 inches during installation.

Firing Pin Recommendations

Hemispherical firing pin with .037 to .050 inch radius tip.

Primer Cup Indentation

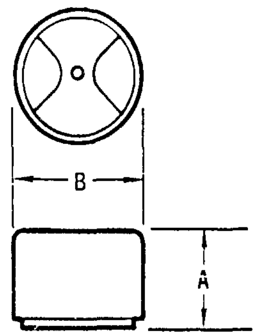
Ideal .020 to .025 inches

(A)

TP88..-17

DATA SHEET NUMBER 6	PRIMER DESIGNATION: 72-G11

Manufacturer's Dimensions

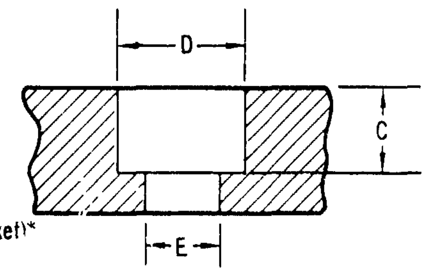


Dimension 'A' .125 to .132 inches*

Dimension 'B' .2100 to .2115 inches, however the two petal anvil gives an eccentricity of up to .2130 inches.

*Note: For ease of assembly hand inspect and select only those primers that fall between .128 to .132 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole



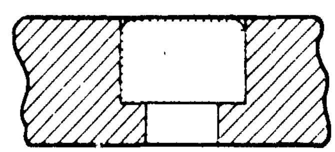
Dimension 'C' .126 ± .001 inches.

Dimension 'D' .2090 ± .0004 inches (use for brass primer pocket)*

Dimension 'E' .095 ± .010 inches (use for propellant powder ignition)

*Note: These dimensions require an 80 to 100 pound installation force for the primer within the primer pocket.

Primer Reconsolidation



Remington recommends that the primers be reconsolidated (seating the anvil) from .002 to .006 inches during installation.

Firing Pin Recommendations

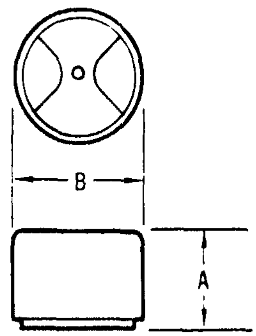
Hemispherical firing pin with .037 to .050 inch radius tip.

Primer Cup Indentation

Ideal 025 to 030 inches

DATA SHEET NUMBER 7	PRIMER DESIGNATION: M42-5086

Manufacturer's Dimensions

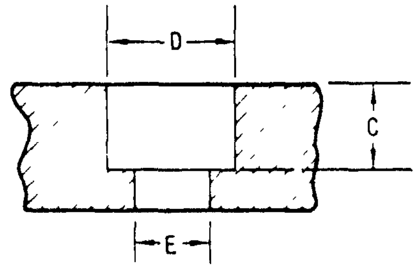


Dimension 'A' .111 to .119 inches.*

Dimension 'B' .1748 to .1756 inches, however the two petal anvil gives an eccentricity of up to .1761 inches.

*Note: For ease of assembly hand inspect and select only those primers that fall between .115 and .119 inches. Primers can then be pressed flush into primer pocket to achieve the desired reconsolidation.

Primer Pocket and Flash Hole

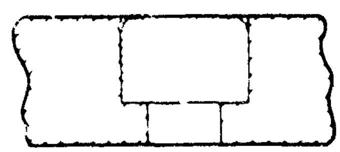


Dimension 'C' .113 ± .001 inches.

Dimension 'D' .1740 ± .0005 inches (use for brass primer pocket).

Dimension 'E' .095 ± .005 inches (use for pyrotechnic time delay ignition).
.080 ± .010 inches (use for explosive train or propellant powder ignition).

Primer Reconsolidation



Olin recommends that primers be reconsolidated (seating the anvil) from .002 to .006 inches during installation

Firing Pin Recommendations

Hemispherical firing pin with .045 inch radius tip

Primer Cup Indentation

Ideal .020 to .025 inches

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